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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
BEHNCKE, CHRISTINE M	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/811,460	ESTKOWSKI ET AL.	
	Examiner	Art Unit	
	Christine M. Behncke	3661	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11, 13-26* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *3/26/04* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/2/06, 4/7/05, 7/14/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☒ Other: Non-patent literature

DETAILED ACTION

This office action is in response to the application filed 26 March 2004, in which claims 1-26 were presented for examination.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-1, 13, 14, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Bruce et al., "Real-Time Randomized Path Planning for Robot Navigation", IEEE, October 2002.

Bruce et al. teaches a method of planning at least one path for an object in a state space from a starting position to a goal position to avoid a plurality of static and/or dynamic objects (column 3, lines 32-45), comprising: (a) associating predetermined attributes with the plurality of static objects and/or the plurality of dynamic objects located in the state space (column 3, lines 32-45); (b) generating a probabilistic tree in the state space including a plurality of branches extending from the starting position of the vehicle towards the goal position located in the state space (column 2, lines 17-30); and (c) extending the plurality of branches of the probabilistic tree towards the goal position located in the state space based on at least one of a plurality of random tree extension rules and a plurality of deterministic tree extension rules until satisfying a predetermined stopping condition (column 2, lines 17-30, column 5, lines 3-15); and

(d) evaluating at least a first branch of the plurality of branches of the probabilistic tree for determining whether the first branch of the plurality of branches of the probabilistic tree satisfies predetermined trajectory path constraints (column 2, lines 17-30).

(**Claim 2**) Bruce et al. further describes wherein if the first branch of the plurality of branches of the probabilistic tree conforms to the predetermined trajectory path constraints, the method further includes: (e) declaring the first branch of the plurality of branches of the probabilistic tree as the at least one preferred trajectory path for the vehicle in the state space (column 10, lines 4-29); and (f) controlling the vehicle to follow the at least one preferred trajectory path in the state space for moving the vehicle from the starting position towards the goal position in the state space (column 10, line 4-column 11, line 14).

(**Claim 3**) Bruce et al. further describes wherein if the first branch of the plurality of branches of the probabilistic tree fails to conform to the predetermined trajectory path constraints, the method further includes: (g) extending the plurality of branches of the probabilistic tree further based on the at least one of the plurality of random tree extension rules and the plurality of deterministic tree extension rules until at least one branch of the plurality of branches of the probabilistic tree satisfies the predetermined stopping condition and conforms to the predetermined trajectory path constraints (column 2, lines 17-30, column 4, lines 18-41).

(**Claim 4**) Bruce et al. further describes (h) declaring the at least one branch of the plurality of branches of the probabilistic tree that couples the starting position to the goal position and that conforms to the predetermined trajectory path constraints as the

at least one preferred trajectory path for the vehicle in the state space (column 10, lines 4-29); and (i) controlling the vehicle to follow the at least one preferred trajectory path in the state space for moving the vehicle from the starting position towards the goal position in the state space (column 10, line 4-column 11, line 14).

(**Claim 5**) Bruce et al. further teaches (j) repeating one or more of steps (a)-(i) at predetermined time intervals as the vehicle moves along the at least one preferred trajectory path toward the goal for updating the at least one preferred trajectory path to compensate for motion of the plurality of dynamic objects (column 3, lines 32-45).

(**Claim 6**) Bruce et al. further teaches wherein satisfying the predetermined stopping condition includes at least one of satisfying a predetermined time constraint and satisfying a predetermined travel distance constraint (column 5, lines 3-15).

(**Claim 7**) Bruce et al. further teaches wherein associating predetermined attributes with the plurality of static objects and tile plurality of dynamic objects located in tile state space includes associating at least one of a position value, a velocity value, a direction value, an acceleration value and a time value (column 4, lines 18-41).

(**Claim 8**) Bruce et al. further teaches wherein generating the probabilistic tree in the state space further includes: extending each of a first plurality of edges a first predetermined distance and direction from the starting position in the state space to each of a corresponding first plurality of nodes based on the plurality of random tree extension rules and the plurality of deterministic tree extension rules for forming first segments of each of the plurality of branches of the probabilistic tree (column 4, lines 18-49, figure 1).

(**Claim 9**) Bruce et al. further teaches extending at least one of a next successive plurality of edges from each of the first plurality of nodes a second predetermined distance and direction in the state space to each of a corresponding next successive plurality of nodes based on the plurality of random tree extension rules and the plurality of deterministic tree extension rules for forming next successive segments of each branch of the plurality of branches of the probabilistic tree (column 7, line 22-column 9, line 14, figure 1).

(**Claim 10**) Bruce et al. further teaches repeating cyclically extension of each branch of the plurality of branches of the probabilistic tree until at least the first branch of the plurality of branches of the probabilistic tree satisfies the stopping condition (column 4, lines 18-49, column 5, lines 3-15, figure 1).

(**Claim 11**) Bruce et al. further teaches evaluating whether extension of one or more branches of tile plurality of branches of the probabilistic tree violate object avoidance constraints (column 4, lines 18-41); and suspending further extension of the one or more branches of the plurality of branches if a determination is made that extension of the one or more branches of the plurality of branches of the probabilistic tree violate the object avoidance constraints (column 4, lines 18-41).

(**Claim 13**) Bruce et al. further teaches wherein extending the plurality of branches of the probabilistic tree based on the plurality of random tree extension rules includes at least one of extending each branch into the state space that is void of the plurality of static objects and the plurality of dynamic objects and extending each branch

into the state space that is void of other branches of the plurality of branches of the probabilistic tree (column 4, lines 18-41).

(**Claim 14**) Bruce et al. further teaches wherein extending the plurality of branches of the probabilistic tree based on the plurality of deterministic tree extension rules includes at least one of extending each branch towards the goal and extending each branch in a straight line with respect to a previous extension of each branch (column 10, lines 4-29).

(**Claim 22**) Bruce et al. describes a method of adaptive path planning for a vehicle, comprising: defining a state space for the vehicle and a plurality of objects (abstract); setting a root node to initial state for the vehicle (column 3, lines 32-45); generating a plurality of paths comprising node-to-nod branches from a vehicle start location to a goal location (column 2, lines 17-30); examining each of the branches to determine whether stopping conditions are satisfied (column 2, lines 17-30, column 5, lines 3-15); generating first ones of the branches using deterministic rules (column 5, lines 3-15); generating second ones of the branches using random extension rules (column 6, line 19-column 7, line 19); determining whether first ones of the plurality of branches should terminated (column 5, lines 3-15); and selecting a first one of the plurality of paths that extend to the goal location (column 10, lines 4-29).

(**Claim 23**) Bruce et al. further teaches further including assigning state information to the plurality of objects including one or more of position, heading, velocity, acceleration, turning radius, acceleration limit, velocity limit, g-force limit, and location confidence level (column 4, lines 18-41).

Claim Rejections - 35 USC § 102

Claims 16-18 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Hsu et al., "Randomized Kinodynamic Motion Planning with Moving Obstacles", March 2002, The Institute of Electrical Engineers.

(**Claim 16**) Hsu et al. describes a path planning method for a vehicle, comprising: defining a state space including an initial start position and a goal position (page 2, lines 5-29); generating a plurality of paths from the start position to the goal position over time on a node by node basis based upon a set of rules including at least one of a deterministic rule, a randomness rule, and a probabilistic rule (page 2, lines 5-29); assigning locations to objects in the state space over time based upon respective probability distributions (page 20, lines 1-20, figure 7); and selecting a first one of the generated plurality of paths (page 11, lines 7-37).

(**Claim 17**) Hsu et al. further teaches including terminating ones of the plurality of paths that are not feasible at a given node in the state space (page 11, lines 7-37).

(**Claim 18**) Hsu et al. further teaches including terminating paths based upon one or more of impact with an object, region avoidance, g-force limitations, sensor information, path distance, path time, number of turns, altitude change limitations, straight path desirability, object location confidence level, turning radius limitations, and turning penalties (page 11, lines 7-37).

(**Claim 20**) Hsu et al. further teaches including assigning object state information including one or more of position, heading, velocity, acceleration, turning radius,

acceleration limit, velocity limit, g-force limit, and location confidence level (page 26, lines 7-17).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al.

Hsu et al. describes a system to plan a path to a vehicle comprising: a workstation including a processor coupled to a memory containing instructions to enable the steps of (page 24, lines 15-28): defining a state space for the vehicle and a plurality of objects (pages 8-10); setting a root node to initial state for the vehicle (page 2, lines 5-29); generating a plurality of paths comprising node-to-nod branches from a vehicle start location to a goal location (page 10, line 23-page 12); examining each of the branches to determine whether stopping conditions are satisfied (page 11, lines 7-37); generating first ones of the branches using deterministic rules (page 20, line 21-page 21); generating second ones of the branches using random extension rules (page 20, line 21-page 21); determining whether first ones of the plurality of branches should terminated (page 11, lines 7-37); and selecting a first one of the plurality of paths that extend to the goal location (page 11, lines 7-37). Hsu further teaches using this navigation planning system with a vehicle (abstract). Hsu et al does not describe first

formulating the path plan on a workstation then downloading the selected path to a vehicle, however this would have been obvious to one of ordinary skill in the art if the selected robot does not have the required processing power or if time/expense of the robot must be restricted.

(**Claim 25**) Hsu et al. further teaches including program instructions to provide state information to the plurality of objects including one or more of position, heading, velocity, acceleration, turning radius, acceleration limit, velocity limit, g-force limit, and location confidence level (page 26, lines 7-17).

Claim Rejections - 35 USC § 103

Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al. as applied to claim 16 above, and further in view of LaValle et al., "Randomized Kinodynamic Planning", May 10 1999, pages 473-479, Volume 1, Detroit Michigan.

Hsu et al does not describe using a confidence level of object locations or assigning a probability distribution to the object station information. However, LaValle et al. teaches a path planning system wherein the system assigns a confidence level to object locations and a probability distribution to one or more components of the objects (column 4, lines 13-34). It would have been obvious to one of ordinary skill in the art to combine the method of Hsu et al. with the teachings of LaValle et al. because assigning a probability to the component of an object and a confidence level to the object location allows the robot to move possibly closer to the object, and increases the range of possible trajectories towards the goal.

Allowable Subject Matter

Claim 12 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christine M. Behncke whose telephone number is (571) 272-8103. The examiner can normally be reached on 8:30 am- 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas G. Black can be reached on (571) 272-6956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CMB

THOMAS BLACK
SUPERVISORY PATENT EXAMINER